

AMENDMENTS TO THE CLAIMS

Listing of Claims:

This listing of claims will replace all prior version, and listings, of claims in the application:

Claim 1 (Currently Amended): An image processing method comprising:

a determination step of determining a plurality of areas, each of which includes a plurality of pixels, arranged in a direction on an image;

a ~~representative value~~ first calculation step of calculating a ~~representative~~ first value determined ~~in regard of~~ corresponding to each of said plurality of areas, ~~from a pixel value based on pixel values~~ of each area;

a ~~density gradient~~ second calculation step of calculating a second value concerning a first order differential value ~~from~~ between each combination of the two representative values ~~in the representative values calculated in said representative value calculation step;~~

~~an evaluation~~ a third calculation step of calculating a third value ~~representing an irradiation end from each combination of the values concerning the first order differential value in the values concerning the first order differential value calculated in said density gradient calculating step~~ concerning using each combination of the two second values; and

a judgment step of judging an edge point of an irradiation area from the ~~value representing the irradiation end calculated in said evaluation step~~ third value.

Claim 2 (Currently Amended): A method according to Claim 1, further comprising a step of extracting the irradiation area from a plurality of the edge points ~~obtained in said obtaining step.~~

Claim 3 (Currently Amended): A method according to Claim 1, wherein each of the first values representing different one of the plurality of areas is an average value of pixel values in the corresponding area.

Claim 4 (Currently Amended): A method according to Claim 1, wherein each of the first values representing different one of the plurality of areas is a median value of pixel values in the corresponding area.

Claim 5 (Currently Amended): A method according to Claim 1, wherein each of the first values representing different one of the plurality of areas is an average value of a limited number of pixel values in the corresponding area.

Claim 6 (Currently Amended): A method according to Claim 1, wherein each of the first values representing different one of the plurality of areas is a median value of a limited number of pixel values in the corresponding area.

Claim 7 (Currently Amended): A method according to Claim 1, wherein each of the first values representing different one of the plurality of areas is calculated by integrating pixel values in a direction in the corresponding area.

Claim 8 (Currently Amended): A method according to Claim 1, wherein each of the first values representing different one of the plurality of areas is obtained by smoothing pixel values in the corresponding area.

Claim 9 (Currently Amended): An image processing method comprising:
a ~~detecting~~ selecting step of ~~calculating~~ selecting candidates for edge points of an irradiation area ~~from~~ in an image area;
~~an evaluating~~ a calculating step of calculating an evaluation value for evaluating positional relations among candidates ~~coordinates of the candidates for the edge points of the irradiation area calculated in said detecting step or positional relations between a predetermined coordinate and the coordinates of the candidates for the edge points of the irradiation area; and~~
a judging step of judging whether ~~photographing~~ radiographing is performed by an imaging device having an irradiation diaphragm function in a state of irradiation diaphragm or in a state of no irradiation diaphragm, based on the evaluation value ~~calculated in said evaluating step.~~

Claims 10-22 (Canceled)

Claim 23 (Previously Presented): An image processing apparatus, comprising:

determination means for determining a plurality of areas, each of which includes a plurality of pixels, arranged in a direction on an image;

representative value calculation means for calculating a representative value determined in regard of each of said plurality of areas, from a pixel value of each area;

density gradient calculation means for calculating a value concerning a first order differential value from each combination of the two representative values in the representative values calculated by said representative value calculation means;

evaluation means for calculating a value representing an irradiation end from each combination of the values concerning the first order differential value in the values concerning the first order differential value calculated by said density gradient calculating means; and

judgment means for judging an edge point of an irradiation area from the value representing the irradiation end calculated by said evaluation means.

Claim 24 (Previously Presented): An image processing apparatus comprising:

detecting means for calculating candidates for edge points of an irradiation area from an image area;

evaluating means for calculating an evaluation value for evaluating positional relations among coordinates of the candidates for the edge points of the irradiation area calculated by said detecting means or positional relations between a predetermined

coordinate and the coordinates of the candidates for the edge points of the irradiation area;
and

judging means for judging whether photographing is performed by an imaging device having an irradiation diaphragm function in a state of irradiation diaphragm or in a state of no irradiation diaphragm, based on the evaluation value calculated by said evaluating means.

Claim 25 (Canceled)

Claim 26 (Currently Amended): A computer-readable storage medium storing a program for making a computer execute an image processing method, said method comprising:

a determination step of determining a plurality of areas, each of which includes a plurality of pixels, arranged in a direction on an image;

a ~~representative value~~ first calculation step of calculating a ~~representative~~ first value determined ~~in regard of~~ corresponding to each of said plurality of areas, ~~from a pixel value based on pixel values~~ of each area;

a ~~density gradient~~ second calculation step of calculating a second value concerning a first order differential value ~~from~~ between each combination of the two representative values ~~in the representative values calculated in said representative value calculation step;~~

~~an evaluation~~ a third calculation step of calculating a third value ~~representing an irradiation end from each combination of the values concerning the first order differential~~

~~value in the values concerning the first order differential value calculated in said density~~
~~gradient calculating step~~ concerning using each combination of the two second values; and
a judgment step of judging an edge point of an irradiation area from the ~~value~~
~~representing the irradiation end calculated in said evaluation step~~ third values.

Claim 27 (Currently Amended): A computer-readable storage medium storing a program for making a computer execute an image processing method, said method comprising:

a ~~detecting~~ selecting step of ~~calculating~~ selecting candidates for edge points of an irradiation area ~~from~~ in an image area;

~~an evaluating~~ a calculating step of calculating an evaluation value for evaluating positional relations among candidates ~~coordinates of the candidates for the edge points of the irradiation area calculated in said detecting step or positional relations between a predetermined coordinate and the coordinates of the candidates for the edge points of the irradiation area~~; and

a judging step of judging whether ~~photographing~~ radiographing is performed by an imaging device having an irradiation diaphragm function in a state of irradiation diaphragm or in a state of no irradiation diaphragm based on the evaluation value ~~calculated in said evaluating step~~.

Claim 28-31 (Canceled)

Claim 32 (Currently Amended): A method according to claim 9, wherein said ~~selection~~ ~~detection~~ step comprises:

a step of determining a plurality of areas, each of which including a plurality of pixels, arranged in a direction on an image;

a step of calculating second order difference values from values each of which represents different one of the plurality of areas; and

a step of obtaining an end point of an irradiation area from the second order difference values calculated in said calculation step.

Claim 33 (Currently Amended): A method according to Claim 9, wherein in said ~~evaluation~~ calculating step, variance of positions of edge points ~~detected~~ selected in said ~~detection~~ selecting step is calculated.

Claim 34 (Canceled)

Claim 35 (Currently Amended): A method according to Claim 9, wherein in said calculating ~~evaluation~~ step, whether positions of edge points selected ~~detected~~ in said selecting ~~detection~~ step are close to each other is evaluated.

Claim 36 (Canceled)

Claim 37 (Currently Amended): A method according to Claim [[9]] 46, wherein said ~~evaluation~~ calculating step comprises:

a step of comparing an average position of positions of edge points ~~detected~~ selected in said ~~detection~~ selecting step with a predetermined position.

Claim 38 (Currently Amended): A method according to Claim 37, wherein said ~~evaluation~~ calculating step further comprises:

a step of calculating variance of positions of edge points ~~detected~~ selected in said ~~detection~~ selection step, in accordance with a comparison result in said comparison step.

Claim 39 (Previously Presented): A method according to Claim 32, wherein in said obtaining step, the edge point is obtained from the second order difference values and signs of first order difference values calculated from the values each of which represents different one of the plurality of areas.

Claim 40 (Canceled)

Claim 41 (Currently Amended): A method according to Claim 1, wherein, in said ~~evaluation~~ third calculation step, a second order differential value is used as the third value ~~representing the irradiation end~~.

Claim 42 (Currently Amended): An image processing method according to claim 1, wherein

in said ~~density gradient~~ second calculation step, the first order differential value is calculated from each combination of the adjacent representative values in the representative values calculated in said representative value calculation step; and

in said ~~evaluation~~ third calculation step, a second order difference value is calculated as a value representing an irradiation end from each combination of the adjacent first order differential values, in the first order differential values calculated in said density gradient calculating step.

Claim 43 (Previously Presented): An image processing method comprising:
a detection step of calculating candidates for edge points of an irradiation area from an image area;

an evaluation step of calculating an evaluation value for evaluating positional relations among coordinates of the candidates for the edge points of the irradiation area calculated in said detection step or positional relations between a predetermined coordinate and the coordinates of the candidates for the edge points of the irradiation area; and

a judgment step of judging whether photographing is performed by an imaging device having an irradiation diaphragm function in a state of irradiation diaphragm or in a state of no irradiation diaphragm, based on the evaluation value calculated in said evaluating step.

Claim 44 (Currently Amended): An irradiation image pickup apparatus having an irradiation area extraction function, comprising:

X-ray irradiation means having a function of an irradiation diaphragm function for irradiating ~~a radiant ray including~~ an X-ray;

a sensor for converting the X-ray ~~irradiated by said X-ray irradiation means~~ into a ~~radiographic~~ an image signal;

a determination means for determining a plurality of areas, each of which includes a plurality of pixels, arranged in a direction ~~of the radiographic image signal input by said sensor~~ on the image;

~~representative value~~ a first calculation means for calculating a ~~representative first~~ value determined ~~in regard of~~ corresponding to each of said plurality of areas, ~~from a pixel value based on pixel values~~ of each area;

~~density gradient~~ a second calculation means for calculating a second value concerning a first order differential value ~~from each combination of the two representative values in the representative values calculated by said representative value calculation means~~ between each combination of the two representative values;

~~evaluation~~ a third calculation means for calculating a third value ~~representing an irradiation end from each combination of the values concerning the first order differential value, in the values concerning the first order differential calculated by the said density gradient calculation means~~ using each combination of the two second values; and

a judgment means for judging an edge point of an irradiation area from the ~~value representing the irradiation end calculated by said evaluation means~~ third values.

Claim 45 (Currently Amended): An ~~X-ray~~ irradiation image pickup apparatus which is equipped with an image discrimination apparatus of judging whether or not photographing is performed by using an irradiation diaphragm, comprising:

X-ray irradiation means having a function of an irradiation diaphragm ~~function~~ for irradiating ~~a radiant ray including~~ an X-ray;

a sensor for converting the X-ray ~~irradiated by said X-ray irradiation means into a radiographic image signal~~ into an image;

~~detection~~ a selecting means for ~~calculating~~ selecting candidates for edge points of an irradiation area ~~from the radiographic image signal input by said sensor~~ in the image;

~~evaluation~~ a calculating means for calculating an evaluation value for evaluating positional relations among ~~coordinates of the candidates for the edge points of the irradiation area calculated in said detection means or positional relations between a predetermined coordinate and the coordinates of the candidates for the edge points of the irradiation area~~;

and

a judging judgment means for judging whether ~~photographing~~ radiographing is performed by ~~the X-ray irradiation means~~ an imaging device having an irradiation diaphragm function in a state of irradiation diaphragm or in a state of no irradiation diaphragm, based on the evaluation value ~~calculated by said evaluating means~~.

Claim 46 (New): An image processing method comprising:

a selecting step of selecting candidates for edge points of an irradiation area in an image;

a calculating step of calculating an evaluation value for evaluating positional relations between a predetermined coordinate and the candidates; and

a judging step of judging whether radiographing is performed by an imaging device having an irradiation diaphragm function in a state of irradiation diaphragm or in a state of no irradiation diaphragm based on the evaluation value.

Claim 47 (New): An irradiation image pickup apparatus which is equipped with an image discrimination apparatus of judging whether or not photographing is performed by using an irradiation diaphragm, comprising:

X-ray irradiation means having a function of an irradiation diaphragm for irradiating an X-ray;

a sensor for converting the X-ray image;

a selecting means for selecting candidates for edge points of an irradiation area in the image;

a calculating means for calculating an evaluation value for evaluating positional relations among between a predetermined coordinate and the candidates; and

a judging means for judging whether radiographing is performed by an imaging device having an irradiation diaphragm function in a state of irradiation diaphragm or in a state of no irradiation diaphragm, based on the evaluation value.

Claim 48 (New): A computer-readable storage medium storing a program for making a computer execute an image processing method, said method comprising:

a selecting step of selecting candidates for edge points of an irradiation area in an image;

a calculating step of calculating an evaluation value for evaluating positional relations between a predetermined coordinate and the candidates; and

a judging step of judging whether radiographing is performed by an imaging device having an irradiation diaphragm function in a state of irradiation diaphragm or in a state of no irradiation diaphragm, based on the evaluation value.

Claim 49 (New): An image processing method comprising:

a first calculation step of calculating first values representing a gradient of an image in a direction on the image;

a second calculation step of calculating second values representing a degree of change of the gradient of the image based on the first values; and

a judgment step of judging an edge point of an irradiation area from the second values.

Claim 50 (New): A method according to claim 46, wherein said selection step comprises:

a step of determining a plurality of areas, each of which including a plurality of pixels, arranged in a direction on an image;

a step of calculating second order difference values from values each of which represents different one of the plurality of areas; and

a step of obtaining an end point of an irradiation area from the second order difference values calculated in said calculation step.